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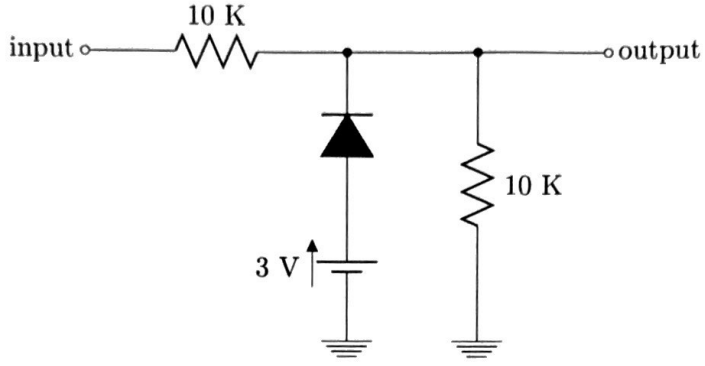
Electronics for Scientists

Diode Circuit

Instructions

Complete the following exercises to the best of your ability.

1. A 60 Hz sinusoidal signal with a RMS voltage of 12 V is applied to the below circuit.



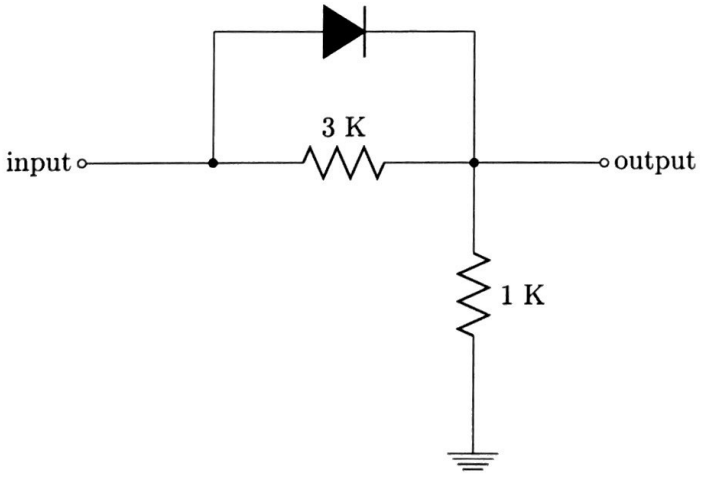
(a) If the diode is "off", what does the circuit look like?

(b) If the diode is "on", what is the output voltage?

(c) For what input voltage is the diode in the circuit "on"?

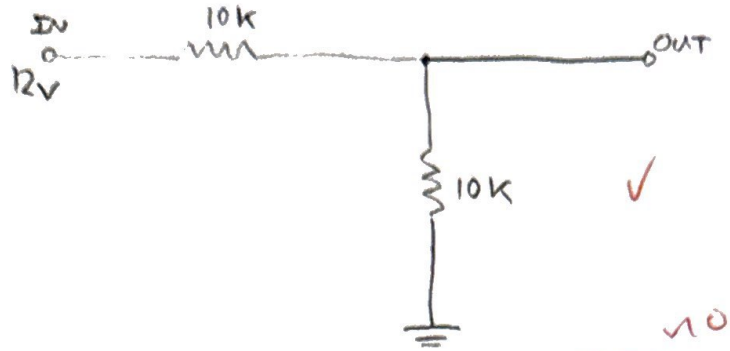
(d) Sketch the output voltage versus time.

2. A 60 Hz sinusoidal signal with a RMS voltage of 12 V is applied to the below circuit. Sketch the output voltage versus time.



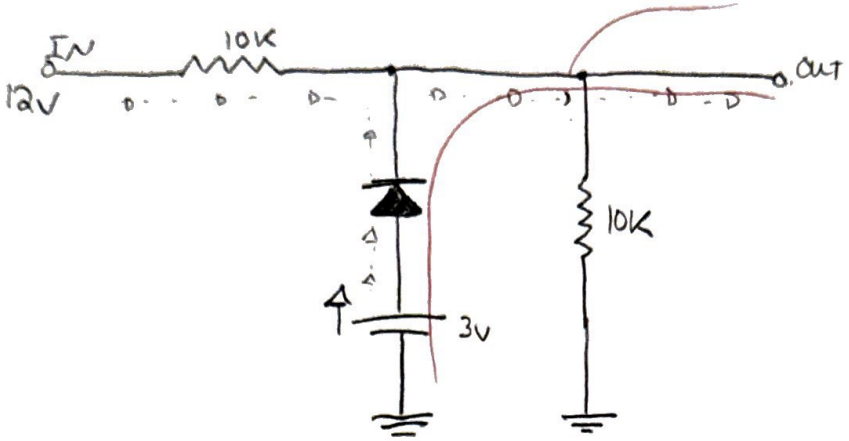
1.)

a)



✓

b.)



no resistors here so it's a short!

$3V - 0.6V = V_{out}$

$V_{out} = 2.4V$

when diode on

$12v - I(10k) - I(10k) = V_{out}$

$12.6v - I(10k) - 3.6v = V_{out}$ ✓

$12V - I(10k) - I(10k) = 9.0V - I(10k)$

$3.0V = +I(10k)$

$I = \frac{3.0V}{10k} = 0.3mA$

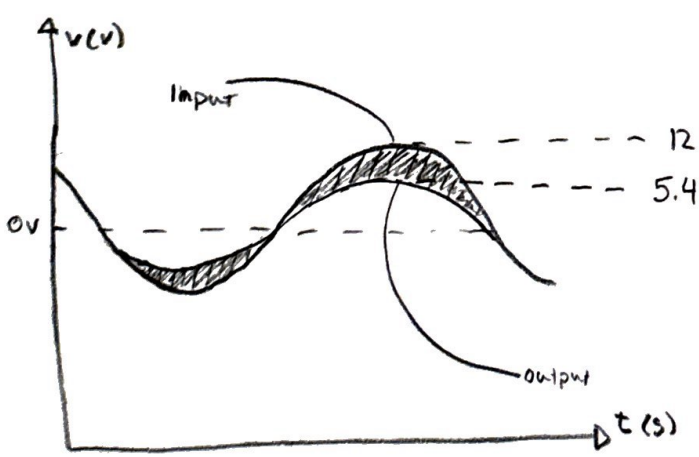
$V_{out} = 12v - (0.3mA)(10k) - 3.6V = 5.4V$

$V_{out} = 5.4v$ ✓

c.) Since input is 12.0V, the required input voltage must be 12.6v to turn on the diode.

$V = 12.6v$

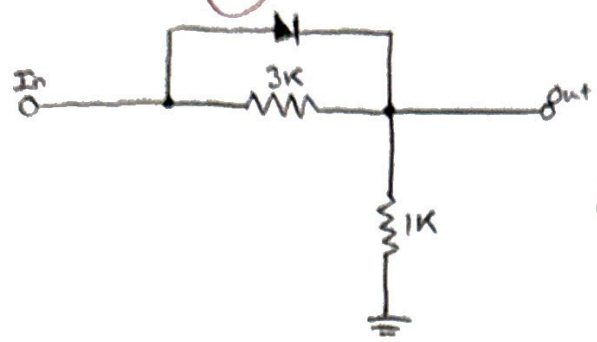
d.)



5.4V when input signal ≥ 12.6V

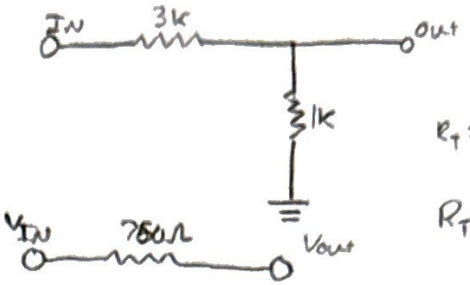
2)

· $f = 60\ Hz$ $V_{RMS} = 12V$



$V = 12V$

When 12V



$R_T = \frac{R_1 R_2}{R_1 + R_2} = \frac{1(3)}{3+1} = \frac{3}{4}k$

$R_T = 750\Omega$

$12V - I(3K) = V_{out}$

$12V - I(3k) - I(1k) = 0$

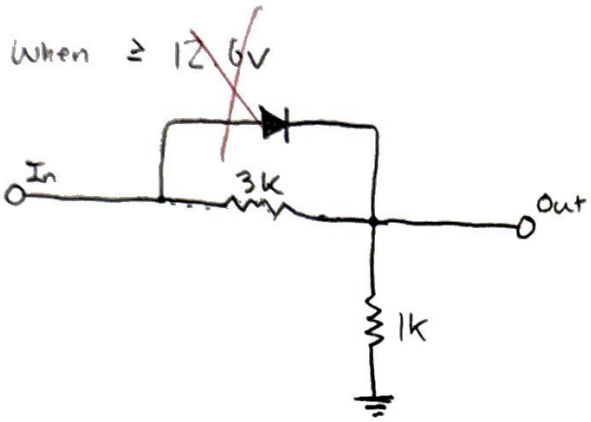
$I(4k) = 12V$

$I = \frac{12V}{4k} = 3mA$

$V_{out} = 12V - 3mA(3k) = 3V$

$V_{out} = 3V$

When $\geq$ ~~12.6V~~



$12.6V - I(3k) - 0.6V = V_{out}$

$12.6V - I(3k) - 0.6V - I(1k) = 0$

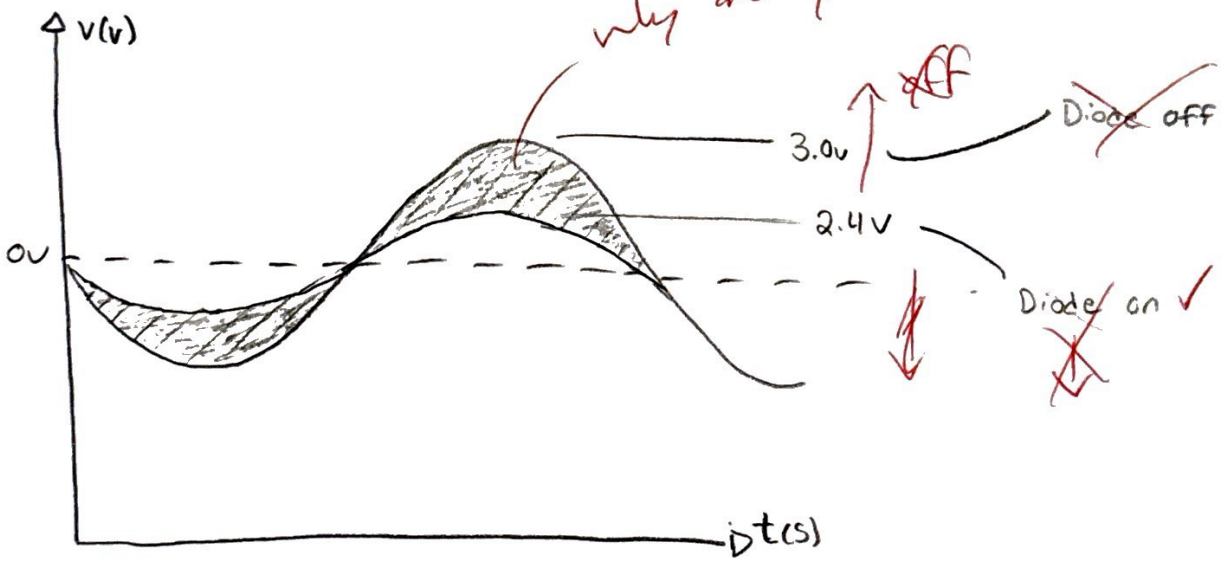
$12V = I(4k)$

$I = 3mA$

$12V - 3mA(3k) - 0.6V = V_{out}$

$V_{out} = 2.4V$

why are you shading this area?



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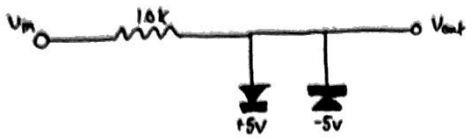
1.22



The diodes will only turn on when the respected inputs are -5.6v and 5.6v or greater.